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PPP-WTP PDC
WB 10/1/03
INIT DATE

Document title:

System Logic Description for Pretreatment Facility Treated LAW Concentrate Storage Process System

Contract number: DE-AC27-01RV14136

Department: Controls and Instrumentation

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Document number: 24590-PTF-PER-J-02-012, Rev 0

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Date of issue:

9/25/03

Issue status:

Issued for Permitting Use

Approved by:

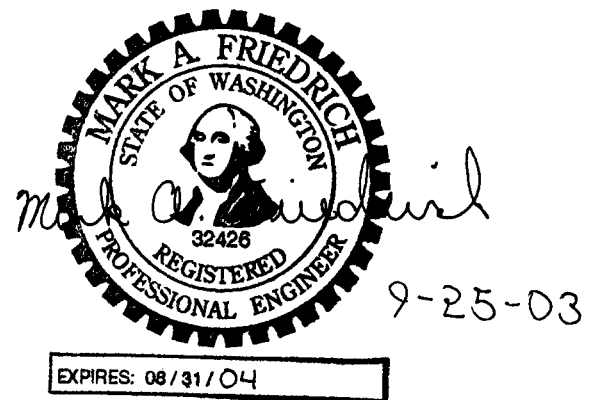
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This bound document contains a total of 12 sheets

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History Sheet

Rev	Date	Reason for revision	Revised by
0	25 September 2003	Issued for Permitting Use	MAF

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Acronyms and Abbreviations

Reference the *P&ID Symbols and Legend Sheets*, as listed in the Applicable Documents section, for acronyms and abbreviations employed on the attached figures.

CXP	cesium ion exchange process
FRP	waste feed receipt process
LAH	level alarm high
LAW	low-activity waste
LCP	LAW concentrate receipt process
LOL	lower operating limit
PCS	process control system
PJM	pulse-jet mixer
PJV	pulse-jet ventilation
PT	pretreatment
PWD	plant wash and disposal
TCP	treated LAW concentrate storage process
TLP	treated LAW evaporation process
UFP	ultrafiltration process
UOL	upper operating limit
WTP	Hanford Tank Waste Treatment and Immobilization Plant

Glossary

acquire	Acquire is a command under a batch control that reserves a group of equipment for that particular batch control.
actual volume	Actual volume is the amount, in US gallons, of waste and process fluid in any vessel.
available space	Available space refers to the volume, in US gallons, of waste and process fluid that any vessel can accommodate and still be below the upper operating limit (UOL). Available space can be calculated as follows: <i>Available Space = UOL - Actual Volume</i> .
available volume	Available volume refers to the volume, in US gallons, of waste and process fluid that any vessel can transfer to another vessel and still remain above the lower operating limit (LOL). Available volume can be calculated as follows: <i>Available Volume = Actual Volume - LOL</i> .
batch	This refers to material that is being produced or that has been produced by a single execution of a batch process.
batch control	This term refers to control activities and control functions that provide an ordered set of processing activities to complete a batch process.
batch process	A batch process leads to the production of a finite quantity of material by subjecting quantities of input material to an ordered set of processing activities over a finite period of time using one or more pieces of equipment.
exception handling	This term refers to the functions that deal with plant or process contingencies and other events that occur outside the normal or desired behavior of batch control.
permissive	A permissive is an interlock that allows a device to change state or a sequence to start. Once a device has changed state or a sequence has started, a permissive has no further effect on the device or sequence.
release	Release is a command under a batch control that opens up a group of equipment for any batch control to acquire.
trip	A trip is a conditional interlock that forces a device or a sequence to a defined state. A trip continues to have an effect on the device or sequence until the interlock condition no longer exist.

1 Introduction

This document describes the control logic for dangerous waste regulated systems and components for the Treated LAW Concentrate Storage Process (TCP) system within the pretreatment (PT) facility.

2 Applicable Documents

24590-PTF-M6-TCP-P0001, *P&ID - PTF. Treated LAW Concentrate Storage System TCP-VSL-00001.*

24590-PTF-M6-TCP-P0002, *P&ID - PTF. Treated LAW Concentrate Storage Utility Services – PSA Rack (Q).*

24590-WTP-M6-50-P0001, *P&ID Symbols and Legend Sheet 1 of 6.*

24590-WTP-M6-50-P0002, *P&ID Symbols and Legend Sheet 2 of 6.*

24590-WTP-M6-50-P0003, *P&ID Symbols and Legend Sheet 3 of 6.*

24590-WTP-M6-50-P0004, *P&ID Symbols and Legend Sheet 4 of 6.*

24590-WTP-M6-50-P0005, *P&ID Symbols and Legend Sheet 5 of 6.*

24590-WTP-M6-50-P0006, *P&ID Symbols and Legend Sheet 6 of 6.*

24590-PTF-3YD-TCP-00001, *System Description for Treated LAW Concentrate Storage Process (TCP).*

3 Description

3.1 System Requirement

The vessels and pumps (along with corresponding valves and instrumentation) associated with dangerous waste management within the TCP system are the following:

- TCP-VSL-00001, treated LAW concentrate storage vessel
- TCP-PMP-00001A, treated LAW concentrate transfer pump
- TCP-PMP-00001B, treated LAW concentrate transfer pump

3.1.1 General Process

The TCP system is primarily used as a buffer between the PT facility and the LAW vitrification facility. It is the collection point in the PT facility for treated LAW concentrate, normally from the treated LAW evaporation process (TLP) system evaporator (vessel TLP-SEP-00001), before it is distributed to the LAW vitrification facility. The TCP system stores enough treated concentrate to continue supplying the LAW vitrification facility with feed for approximately seven days in the event of a process interruption in the PT facility.

Additionally the TCP system includes routing for the following:

Event and Route	Notes
Receipt of treated LAW from the Cesium Ion Exchange Process system (vessels CXP-VSL-00026A/B/C)	Infrequent events
Recycle of off-specification LAW concentrate to the TLP system (vessels TLP-VSL-00009A/B)	
Receipt of treated solids from the ultrafiltration process (UFP) system (vessels UFP-VSL-00002A/B)	These upstream transfers will be administratively controlled and require manual installation of a jumper.
Transfer of off-specification LAW concentrate to the waste feed receipt process (FRP) system (vessels FRP-VSL-00002A/B/C/D)	
Transfer and return of excess LAW concentrate to and from the FRP system (vessels FRP-VSL-00002A/B/C/D)	

3.1.2 Treated LAW Concentrate Storage Vessel

Instrumentation, alarms, controls, and interlocks are provided for the TCP system to indicate or prevent the following conditions:

- Vessel contents overflow (level indication)
- Loss of system integrity (black cell or bulge sump level indication)
- Inadvertent transfer (“acquire and release” logic in the process control system (PCS) to control the LAW concentrate transfer pumps)
- Inaccurate vessel level (density compensation to indicate true level)

The treated LAW concentrate storage vessel (TCP-VSL-00001) is designed to receive a continuous feed from the treated LAW evaporation process (TLP) system vessel TLP-SEP-00001. The treated LAW concentrate is then transferred out in batches to the LAW vitrification facility. A batch transfer will be required each time one of the two concentrate receipt vessels (LCP-VSL-00001, LCP-VSL-00002) in the LAW vitrification facility is empty. The capability to transfer treated concentrate to a future LAW vitrification facility is also maintained.

Treated LAW concentrate storage vessel (TCP-VSL-00001) may also receive treated LAW from the cesium ion exchange process system bypassing the TLP system. Treated solids from UFP system vessels UFP-VSL-000002A and UFP-VSL-000002B may also be blended with the treated LAW concentrate in vessel TCP-VSL-00001, if the solids meet the specifications for LAW vitrification. This is not expected to occur very often and requires a jumper, which is not normally installed.

LAW concentrate from LAW concentrate vessel TCP-VSL-00001 can be transferred to (and return back from) the FRP system (waste feed receipt vessels FRP-VSL-00002A, FRP-VSL-00002B, FRP-VSL-00002C, and FRP-VSL-00002D). This is not expected to occur very often and requires a jumper, which is not normally installed.

For better control of any transfer operation for the treated LAW concentrate storage vessel (TCP-VSL-00001), transfers are limited by the batch control transfer-out or transfer-in operation only.

Once the batch control acquires the TCP vessel, no other batch control operation can acquire this vessel until it is released from the initial operation. The acquiring and releasing steps ensure that this vessel cannot transfer in or out, or receive and transfer from multiple destinations at the same time. "Acquire and release" logic does not apply to the discharge of concentrate from the evaporator system TLP.

When one of the treated LAW collection vessels (LCP-VSL-00001 or LCP-VSL-00002) is ready to receive feed from the TCP system, the Operator will initiate the transfer-out batch control operation. This operation will prompt the operator to confirm that all pre-start interface control requirements are satisfied. The sequence will not start until the operator acknowledges the prompt. At this time, the PCS will also be monitoring the parameters that constitute the permissives and trips, and will perform the data transfer between the TCP system and LAW facility.

Once the prompt is acknowledged by the operator and the transfer line is selected, the PCS will automatically align all the necessary valves. The position feedback switches for these valves are monitored by the PCS. If any of the valves are not in the correct position, the sequence will be switched to an exception handling function that stops the transferring operation and initiates pre-determined corrective actions.

Under normal operating conditions the transfer-out sequence in the TCP system, once initiated, will be completed when any of the following occurs:

- The required batch has been transferred and post-transfer flushing and draining are completed.
- The destination vessel reaches its UOL.
- The treated LAW concentrate storage vessel TCP-VSL-00001 level reaches its LOL.

The transferring process to the TCP system stops if the "HIGH-HIGH" level alarm in the ultimate overflow vessel (PWD-VSL-00033) is activated. This action stops any feed from being pumped to or from the TCP system. This interruption will occur regardless of the current status of the transferring process.

When the level in the treated LAW concentrate storage vessel (TCP-VSL-00001) is no longer within the normal operating range, interlocks within the PCS will prevent an overflow. Upon sensing a "HIGH-HIGH" level, the PCS displays a high alarm to the operator and automatically stops all transferring operations to the TCP system.

During the entire transfer-out or transfer-in sequence, the PCS continually monitors the sump alarms within the PT facility and notifies the operator if an alarm condition occurs. The operator can then manually stop the transfer or allow the control system to switch to an exception handling function.

Each step in the batch operation will be performed automatically with built-in operator prompts as dictated by pre-transfer, during-transfer, and post-transfer operator and PCS interfaces and controls listed below.

Action	The Goal of the Action
<ul style="list-style-type: none">• Select one of the three transfer lines	This will allow for proper valve alignment, thereby preventing misrouting of LAW concentrate in PTF and LAW facility

Action	The Goal of the Action
<ul style="list-style-type: none"> Specify the batch feed volume based on the available volume (in US gallons) in the treated LAW concentrate storage vessel (TCP-VSL-00001) and available space in the treated LAW collection vessel (LCP-VSL-00001/2) 	This will control only batch transfers
<ul style="list-style-type: none"> Operator enables transfer 	This will authorized initiation of transfer operation
<ul style="list-style-type: none"> Confirm start (via flow totalizer) of transfer 	This ensures that the valves are aligned properly.
<ul style="list-style-type: none"> Confirm transferring of concentrate via flow totalizer instrumentation 	This ensures a controlled operation
<ul style="list-style-type: none"> Confirm that volume is available in the ultimate overflow vessel (PWD-VSL-00033) to receive transfer line post-flush drain. 	This will prevent overflow to the ultimate overflow vessel (PWD-VSL-00033).
<ul style="list-style-type: none"> Drain pipeline flush 	This will ensure that no flush liquid remains in the lines
<ul style="list-style-type: none"> Secure valving. 	This will ensure that the valves are in the proper position after the transfer.
<ul style="list-style-type: none"> Calculate the actual LAW concentrate volume sent to the LAW facility 	This will confirm sending of actual amount of LAW concentrate to the LAW facility for record keeping

The following are interlocks between the PT facility and the LAW facility that are working all the time. These signals tie into the interlock logic performed within each of the control systems (PT facility and the LAW facility). These trips disable the transfer operation.

Interlock Signal	Usage
<ul style="list-style-type: none"> Valves are not properly aligned in the PT facility for transfer to the LAW facility. 	This signal will avoid deadheading of the transfer pump and will prevent misroute
<ul style="list-style-type: none"> Control valves or associated instrumentation are not functional. 	This will ensure that the transfer can be monitored and controlled.
<ul style="list-style-type: none"> “HIGH” level alarm in transfer line leak pot 	This signal is used as a trip to stop the transfer upon failure of primary containment and preventing overflow of the ultimate overflow vessel (PWD-VSL-00033)
<ul style="list-style-type: none"> “HIGH” level alarm in the black-cell or bulge sumps 	This will prevent initiation or stop transfer if vessel and piping integrity within PTF is suspect
<ul style="list-style-type: none"> “HIGH-HIGH” level alarm in the treated LAW concentrate storage vessel (TCP-VSL-00001) 	This will prevent overflow to the ultimate overflow vessel (PWD-VSL-00033).
<ul style="list-style-type: none"> “HIGH-HIGH” level alarm in any of treated LAW collection vessel (LCP-VSL-00001/2) 	This will prevent overflow to the overflow collection vessel in the LAW facility

Interlock Signal	Usage
<ul style="list-style-type: none">• “HIGH-HIGH” radiation level alarm from radiation monitor• Operator disables transfer	<p>This will prevent transfer of off-specification treated LAW concentrate to the LAW facility</p> <p>This signal will be used as a trip in the TCP system logic to stop the transfer pump.</p>

Figure 1 shows the interlocks and alarms for the level control instruments associated with the treated LAW concentrate storage vessel (TCP-VSL-00001).

3.1.3 Treated LAW Concentrate Transfer Lines

Three buried transfer pipelines (that is, a primary, a spare, and an unconnected spare) will be installed to minimize disruptions to facility throughput in the event of a pipeline block or leak. Each pipeline is a coaxial design with a dedicated leak detection system in the annulus of the pipe. The transfer lines are installed with a downward slope towards the PT facility to allow the line flushes and liquid in the annulus to drain to the ultimate overflow vessel (PWD-VSL-00033). The PCS will alarm and prompt the operator in the event of a leak detected in the transfer system

Figure 1 TCP-LI-0001 for Treated LAW Concentrate Storage Vessel TCP-VSL-00001

